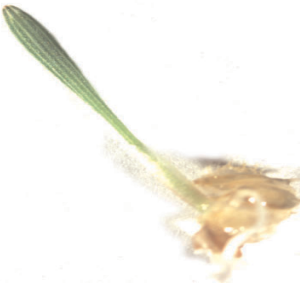


Native and Non-native Plant Seedlings of Northern Arizona



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Ecological Restoration Institute

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Introduction

Southwestern ponderosa pine forests support a wide diversity of understory vegetation, including grasses, forbs, shrubs, and cacti. Plant identification is important in monitoring following a disturbance event or in conducting ecological restoration. The purpose of this photographic guide is to assist ecologists and land managers in seedling identification and restoration monitoring.

Methods

I performed surveys with botanists employed with the Ecological Restoration Institute (ERI) in order to determine the range of species common to the greater Flagstaff area to include in the field guide. I then obtained seeds for the selected species from botanists employed with the ERI and from seed outlets in the Flagstaff area. I performed the necessary pre-germination treatments for each species, then germinated the seeds by placing them on wet filter paper in petri dishes. I also germinated seeds by planting them in potting soil in seed flats. I manually watered the petri dishes and kept the seed flats in a Northern Arizona University greenhouse where they were watered by a timed sprinkler system. When the seedlings began to grow, I photographically documented each species, focusing on distinctive characteristics. I photographed the species with a Leica microscope fitted with an Optronics MagnaFire Sp camera, Model S99805, located in the ERI ecology lab. I also measured characteristics of each species, such as stem size and leaf size, and pressed samples of each stage.

The guide is organized in three sections--grasses, forbs, and shrubs. Each section is organized alphabetically by species. Two photographs of each plant species accompany descriptions of the species at different developmental stages (Note: certain species only have one photograph due to complications in the growing process).

This is the 1st edition of this guide, and will hopefully serve as a template for further editions.

Author

Erin R. Thurston is an Undergraduate Research Assistant with the Ecological Restoration Institute (ERI) and is pursuing a Bachelor of Science degree in Environmental Science at Northern Arizona University. The creation of this identification guide was part of her undergraduate research work with the ERI.

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Grasses- Poaceae

Aristida purpurea

Purple threeawn

Characteristics: **Blades:** narrow, flat blades, 5-7 cm tall @ 1st true leaf, 1 mm wide **Culm:** 8 mm between glume and 1st true leaf **Other:** awns on glume



cotyledon



1st true leaf

Blepharoneuron tricholepis

Pine dropseed

Characteristics: **Blades:** curled tips; 1.5 cm @ 1st true leaf, 1 mm wide; 2-3 cm tall @ 2nd true leaf, 1 mm wide **Culm:** 3 mm between glume and 1st & 2nd true leaf



cotyledon



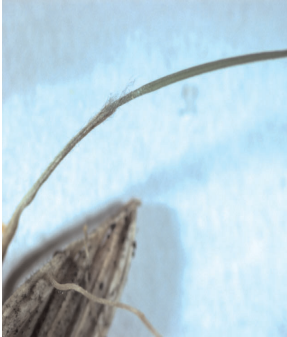
1st true leaf

Poaceae

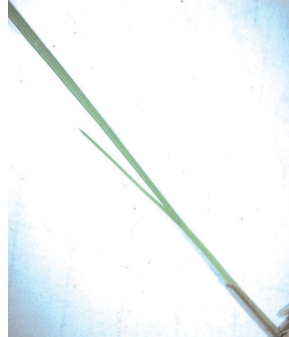
Bouteloua curtipendula

Sideoats grama

Characteristics: Blades: curled tips, flat blades; 4.5 cm tall @ 1st true leaf, 1 mm wide, ciliate margin **Culm:** 1 cm between glume and 1st true leaf



cotyledon



1st true leaf

Bouteloua gracilis

Blue grama

Characteristics: Blades: curled tips, flat blades; 3 cm tall @ 1st true leaf, 1 mm wide **Culm:** 1 cm between glume and 1st true leaf



cotyledon



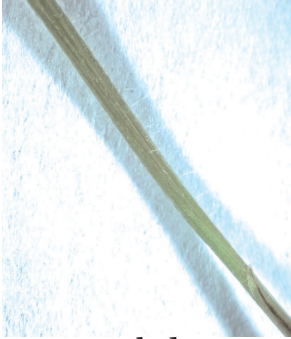
1st true leaf

Poaceae

Bromus tectorum

Cheatgrass

Characteristics: Blades: "corkscrews," but more pubescent than *Elymus*--over whole blade; 4.5 cm tall @ 1st true leaf, 1 mm wide **Culm:** 1 cm between glume and 1st true leaf **Other:** awn on glume; late summer/ early fall germination



cotyledon



1st true leaf

Elymus elymoides

Squirreltail

Characteristics: Blades: "corkscrews," may be pubescent along bottom midvein, flat blade; 6-15 cm tall @ 1st true leaf, 1.5 mm wide; prominent veins **Culm:** reddish, 1-2 cm between glume and 1st true leaf



cotyledon



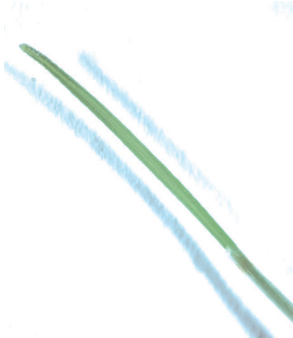
1st true leaf

Poaceae

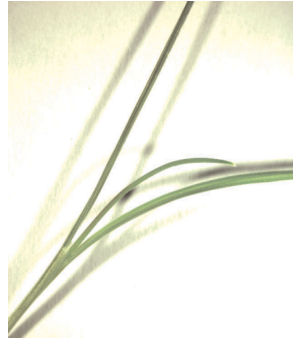
Festuca arizonica

Arizona fescue

Characteristics: Blades: rolled, "hair-like" blade; narrow, straight up & down; 5.5-8.5 cm tall @ 1st true leaf, 0.5 mm wide
Culm: 1.2 cm between glume and 1st true leaf



cotyledon



2nd true leaf

Koeleria macrantha

Prairie Junegrass

Characteristics: Blades: 2.5 cm tall @ 1st true leaf, 0.5 mm wide; 3 cm tall @ 2nd true leaf, <1 mm wide; narrow, flat blades; short compared to Elymus & more blue-green **Culm:** 3 mm between glume and 1st true leaf



cotyledon



2nd true leaf

Poaceae

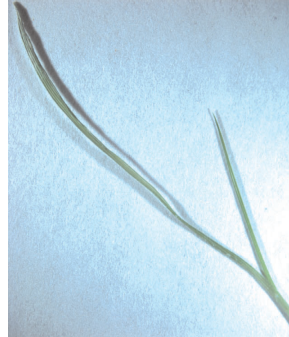
Muhlenbergia montana

Mountain muhly

Characteristics: Blades: 2.5-3 cm tall @ 1st true leaf, 1 mm wide **Culm:** 5 mm between glume and 1st true leaf **Other:** look for prominent ligule by 1st true leaf



cotyledon w/ligule



1st true leaf

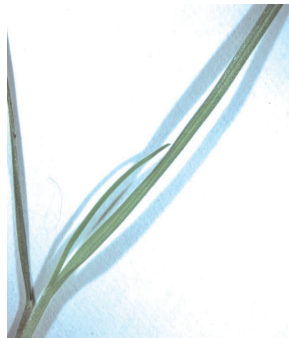
Poa fendleriana

Muttongrass

Characteristics: Blades: curled tips; 4 cm tall @ 1st true leaf, 0.5 mm wide; 6 cm tall @ 2nd true leaf, 2 mm wide **Culm:** 0.5 cm between glume and 1st true leaf **Other:** look for “RR tracks” (2 median lines) by 2nd true leaf



cotyledon



2nd true leaf

Poaceae

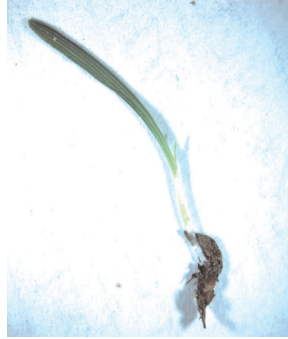
Sporobolus cryptandrus

Sand dropseed

Characteristics: **Blades:** “strap-shaped” leaves; 1 cm @ 1st true leaf, 1 mm wide **Culm:** 2 mm between glume and 1st true leaf



cotyledon



1st true leaf

Forbs- Asteraceae

Centaurea diffusa

Diffuse knapweed

Characteristics: **Cotyledons:** petioled; 4-7 mm long, 3-4 mm wide **True leaves:** opposite simple leaves, “strap-shaped”; toothed margins; pubescent; 1 cm long, 4 mm wide **Stem:** 5-10 mm @ cotyledons; 10 mm @ 1st true leaf



cotyledons



1st true leaf

Packera multilobata

Lobeleaf groundsel

Characteristics: **Cotyledons:** petioled; round; 5 mm long, 4 mm wide **True leaves:** single, simple, alternately toothed; 2 mm long, 1.5 mm wide **Stem:** variable; 3-15 mm @ cotyledons; 3-15 mm @ 1st true leaves **Other:** may have purple on bottom of leaves



cotyledons



1st true leaf

Asteraceae

Senecio eremophilus

Desert ragwort

Characteristics: **Cotyledons:** petioled; 5 mm long, 4 mm wide **True leaves:** single, simple; 8 mm long, 6 mm wide; alternately toothed; may be purple underneath; petiole ciliate
Stem: may be purple; 10 mm @ cotyledon & 1st true leaves



cotyledons



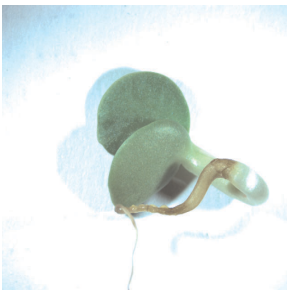
2nd true leaf

Fabaceae

Lupinus argenteus

Silver lupine

Characteristics: **Cotyledons:** fleshy, round, w/distinct petiole; 5 mm long, 9 mm wide **True leaves:** single palmately compound leaf w/5 oblongate leaflets, each 2-4 mm long, 1 mm wide; pubescent **Stem:** 1 cm @ cotyledons; 1-3 cm @ 1st true leaves



cotyledons



1st true leaf

Fabaceae

Oxytropis lambertii

Lambert's locoweed

Characteristics: **Cotyledons:** sessile, fleshy, oval; 8 mm long, 3-5 mm wide **True leaves:** many, linear, ciliate; 5 mm long, 1-2 mm wide **Stem:** 1-1.5 cm @ cotyledons; 1-2 cm @ 1st true leaves



cotyledons



true leaves

Vicia americana

American vetch

Characteristics: **Cotyledons:** sessile; 2 mm long, 1 mm wide **True leaves:** single compound leaf, split all the way to midvein; petioled, linear; 3-5 mm long, 1-2 mm wide **Stem:** 10 mm @ cotyledon; 10-15 mm @ 1st true leaves



cotyledons



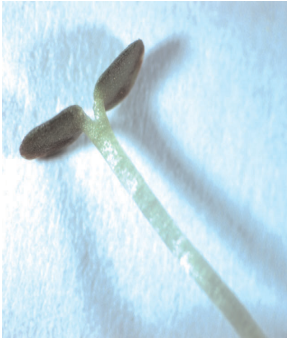
1st true leaf

Rosaceae

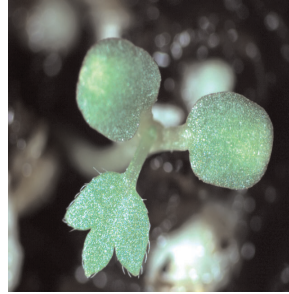
Potentilla crinita

Bearded cinquefoil

Characteristics: **Cotyledons:** round, petioled; 2 mm long, 2 mm wide **True leaves:** single simple leaf; three lobes; ciliate; 2-3 mm long **Stem:** irregular stem; 3-10 mm @ cotyledon; 10 mm @ 1st true leaf



cotyledons



1st true leaf

Scrophulariaceae

Linaria dalmatica

Dalmatian toadflax

Characteristics: **Cotyledons:** sessile, pointed tip; 2 mm long, 1 mm wide **Stem:** can be purple; 10-20 mm @ cotyledon



cotyledons

Scrophulariaceae

Verbascum thapsus

Common mullein

Characteristics: **Cotyledons:** sessile, ciliate, rounded tip;
1 mm long, 1 mm wide **Stem:** 5 mm @ cotyledons



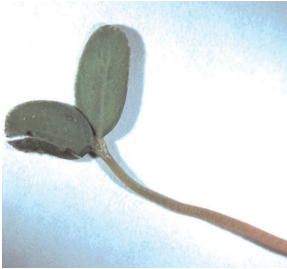
cotyledons

Shrubs- Anacardiaceae

Rhus trilobata

Skunkbush sumac

Characteristics: **Cotyledons:** sessile to subsessile, oval; 7 mm long, 4 mm wide; pink tint underneath; petioles < 1 mm long **True leaves:** single, compound, leaflets ternate w/3 lobes per leaflet, 1.5-2 cm long, 1 cm wide **Stem:** 1-1.5 cm @ cotyledons, 1.5-2.5 cm @ 1st true leaf; pink tint



cotyledons



1st true leaf

Ephedraceae

Ephedra viridis

Mormon tea

Characteristics: **Cotyledons:** none (gymnosperm); 2 leaves initially emerge from seed, much like cotyledons **True leaves:** resemble pine needles; round; 1-2 cm long, 1-2 mm in diameter **Stem:** 5 mm



true leaves w/seed



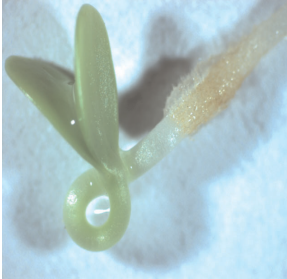
true leaves

Rhamnaceae

Ceanothus fendleri

Fendler's ceanothus

Characteristics: **Cotyledons:** fleshy, round, sessile; 5 mm long, 3 mm wide **Stem:** 9-25 mm @ cotyledons **Other:** ciliate roots



cotyledons

Glossary

Awn- A needle-like extension of the grass floret.

Bract- A modified leaf at the base of a flower or flower cluster. It may resemble a normal leaf, be reduced and scale-like in appearance, or large and brilliantly colored.

Ciliate- Fringed with hairs on the edge.

Cotyledon- The first leaf, pair or whorl of leaves to show after germinating; a seed leaf.

Culm- The jointed stalk or stem of grasses, usually hollow except at the nodes.

Floret- A small flower, usually one of a dense cluster.

Glume- The bracteal covering of the flowers or seeds of grain and grasses.

Ligule- The projecting, usually tongue-like, membranous end of the lining of the leaf sheath, seen at the base of the leaf, between it and the stalk.

Node- Points on a stem from which leaves, shoots, or flowers grow.

Petiole- The stalk of a leaf.

Pubescent- Fuzzy, covered with down or hairs.

Sessile- Leaves and other plant parts that have no stalk, but instead grow directly from the stem of the plant.

Simple leaf- This is a leaf that consists of a single blade, unlike a compound leaf, which has two or more.

Ternate- Arranged in three's; especially said of a leaf with three leaflets, or of leaves whorled in three's.

Appendix A: Species planted but not included due to growing difficulty

Family	Genus	Species
Asteraceae	Solidago	velutina
Chenopodiaceae	Atriplex	canescens
Poaceae	Achnatherum	hymenoides
Rosaceae	Amelanchier	utahensis
Rosaceae	Rosa	woodsii

Appendix B: Species recommended but not included

Family	Genus	Species
Apiaceae	Lomatium	foeniculaceum
Apiaceae	Pseudocymopterus	montanus
Asteraceae	Achillea	millefolium
Asteraceae	Agoseris	glauc
Asteraceae	Antennaria	parvifolia
Asteraceae	Artemisia	carruthii
Asteraceae	Artemisia	dracunculus
Asteraceae	Artemisia	ludoviciana
Asteraceae	Bahia	dissecta
Asteraceae	Brickellia	grandiflora
Asteraceae	Cirsium	vulgare
Asteraceae	Cirsium	wheeleri
Asteraceae	Conyza	canadensis
Asteraceae	Coreopsis	tinctoria
Asteraceae	Ericameria	nauseosa
Asteraceae	Erigeron	colomexicanus
Asteraceae	Erigeron	divergens
Asteraceae	Erigeron	flagellaris
Asteraceae	Erigeron	formosissimus
Asteraceae	Erigeron	neomexicanus

Family	Genus	Species
Asteraceae	Erigeron	speciosus
Asteraceae	Gnaphalium	exilifolium
Asteraceae	Helianthella	quinquenervis
Asteraceae	Heliomeris	multiflora
Asteraceae	Heterotheca	villosa
Asteraceae	Hieracium	fendleri
Asteraceae	Hymenoxys	bigelovii
Asteraceae	Hymenoxys	richardsonii
Asteraceae	Lactuca	serriola
Asteraceae	Laennecia	schiedeana
Asteraceae	Machaeranthera	canescens
Asteraceae	Pseudognaphalium	macounii
Asteraceae	Pyrrocoma	crocea
Asteraceae	Senecio	actinella
Asteraceae	Senecio	wootonii
Asteraceae	Symphyotrichum	falcatum
Asteraceae	Taraxacum	officinale
Asteraceae	Tragopogon	dubius
Boraginaceae	Lappula	occidentalis
Boraginaceae	Lithospermum	multiflorum
Brassicaceae	Arabis	fendleri
Brassicaceae	Thlaspi	montanum
Caprifoliaceae	Symphoricarpos	oreophilus
Caryophyllaceae	Arenaria	fendleri
Caryophyllaceae	Arenaria	lanuginosa
		ssp. saxosa
Chenopodiaceae	Chenopodium	album
Chenopodiaceae	Chenopodium	graveolens
Chenopodiaceae	Chenopodium	leptophyllum
Convolvulaceae	Convolvulus	arvensis
Fabaceae	Astragalus	castaneiformis
Fabaceae	Astragalus	humistratus
Fabaceae	Lathyrus	lanszwertii
		var. leucanthus
Fabaceae	Lupinus	kingii

Family	Genus	Species
Fabaceae	Melilotus	officinalis
Fabaceae	Phaseolus	angustissimus
Fabaceae	Thermopsis	montana var. montana
Fumariaceae	Corydalis	aurea
Geraniaceae	Geranium	caespitosum
Lamiaceae	Marrubium	vulgare
Linaceae	Linum	lewisii
Malvaceae	Malva	neglecta
Malvaceae	Sphaeralcea	parviflora
Nyctaginaceae	Mirabilis	decipiens
Nyctaginaceae	Mirabilis	linearis
Onagraceae	Epilobium	brachycarpum
Onagraceae	Gayophytum	diffusum
Onagraceae	Oenothera	caespitosa
Poaceae	Bromus	ciliatus
Poaceae	Bromus	inermis
Poaceae	Elymus	trachycaulus ssp. trachycaulus
Poaceae	Hordeum	jubatum
Poaceae	Muhlenbergia	rigens
Poaceae	Muhlenbergia	wrightii
Poaceae	Panicum	bulbosum
Poaceae	Piptochaetium	pringlei
Poaceae	Poa	pratensis
Poaceae	Schizachyrium	scoparium
Poaceae	Sporobolus	interruptus
Polemoniaceae	Ipomopsis	aggregata
Polemoniaceae	Phlox	gracilis
Polygonaceae	Eriogonum	alatum
Polygonaceae	Eriogonum	cernuum
Polygonaceae	Eriogonum	racemosum
Polygonaceae	Polygonum	douglasii
Polygonaceae	Rumex	crispus
Portulacaceae	Portulaca	oleracea

Family	Genus	Species
Primulaceae	Androsace	septentrionalis
Ranunculaceae	Thalictrum	fendleri
Rosaceae	Potentilla	hippiana
Rosaceae	Potentilla	subviscosa
Rubiaceae	Houstonia	wrightii
Scrophulariaceae	Castilleja	linariifolia
Scrophulariaceae	Mimulus	rubellus
Scrophulariaceae	Orthocarpus	luteus
Scrophulariaceae	Penstemon	barbatus
Scrophulariaceae	Penstemon	linarioides
Solanaceae	Nicotiana	attenuata